

CLAIMS

1. A cleaning method for cleaning an object, comprising:

wherein the object is cleaned by acting a desired force on the surface of the object to be cleaned in a state that liquid having 50 mPa.s or more of viscosity being contacted to at least the surface of the object to be cleaned.

2. The cleaning method according to claim 1, wherein the desired force is a force generated in association with movement of the liquid.

3. The cleaning method according to claim 1, wherein the desired force is a force generated by moving the object and a member different from the object relatively in a non-contact state.

4. The cleaning method according to claim 1, wherein the desired force is an externally applied force.

5. The cleaning method according to any one of claims 1 to 4, wherein the liquid has a predetermined pH value that can control a zeta potential of the object.

6. The cleaning method according to claim 5, wherein

the pH value of the liquid is at least 6.

7. The cleaning method according to any one of claims 1 to 6, wherein the object is a substrate.

8. The cleaning method according to any one of claims 1 to 7, wherein the object has a patterned structure on the surface.

9. The cleaning method according to any one of claims 1 to 8, wherein the object is a photomask.

10. The cleaning method according to either of claim 8 or claim 9, wherein the object has a pattern having an undercut shape on the surface thereof.

11. A particle removing method for removing an adherent particle from an object, wherein the particle is removed by acting a desired force on the surface of the object to be cleaned in the state that liquid having 50 mPa.s or more of viscosity being contacted to at least the surface of the object to be cleaned.

12. The particle removing method according to claim 11, wherein the desired force is a force generated in

association with movement of the liquid.

13. The particle removing method according to claim 11, wherein the desired force is a force generated by moving the object and a member different from the object relatively in a non-contact state.

14. The particle removing method according to claim 11, wherein the desired force is an externally applied force.

15. The particle removing method for removing an adherent particle from the object, comprising:

making a contact state between liquid and at least a portion of the object to which the particle is adhered; and

moving the liquid at the corresponding portion in the contact state,

wherein said liquid has high viscosity with which a force generated in association with the movement of the liquid becomes larger than an adhesion force of the particle to the substrate.

16. A particle removing method for removing an adherent particle from an object, comprising:

interposing liquid at least between a portion of the object to which the particle is adhered and a member

different from the object; and

moving the object and the member relatively in a non-contact state,

wherein said liquid has high viscosity with which the force generated in association with the relative movement becomes larger than the adhesion force of the particle to the substrate.

17. The particle removing method according to either of claim 14 or claim 15, wherein the viscosity of the liquid is 50 mPa.s or higher.

18. The particle removing method according to any one of claim 11 to claim 17, wherein the liquid has a predetermined pH value that can control the zeta potential of the object.

19. The particle removing method according to any one of claim 11 to claim 18, wherein the object is a substrate.

20. The particle removing method according to any one of claim 11 to claim 19, wherein the object has a patterned structure on the surface.

21. The particle removing method according to any one

of claim 11 to claim 20, wherein the object is a photomask.

22. The particle removing method according to either of claim 20 or claim 21, wherein the object has a pattern having an undercut shape on the surface thereof.

23. A cleaning apparatus for cleaning an object, comprising:

means for producing a contact state between liquid of 50 mPa.s having higher viscosity and at least a surface of the object to be cleaned; and

means for applying a desired force, with the liquid contacted with the surface of the object.

24. The cleaning apparatus according to claim 23, wherein the means for applying the desired force, with the liquid contacted with the surface of the object, also serves as a means for moving the liquid.

25. The cleaning apparatus according to claim 24, wherein the means for applying the desired force, with the liquid contacted with the surface of the object, also serves as a means for relatively moving the object and a member different from the object in a non-contact state.

26. The cleaning apparatus according to claim 25, wherein the member different from the object has a planer area facing the object.

27. The cleaning apparatus according to claim 26, wherein the planar area of the member different from the object has a rugged surface.

28. The cleaning apparatus according to claim 23, wherein the means for applying the desired force, with the liquid contacted with the surface of the object also serves as a means for adding an external force.

29. The cleaning apparatus according to any one of claim 23 to claim 28, further comprising a means for changing the viscosity of the liquid.

30. The cleaning apparatus according to any one of claim 23 to claim 29, wherein the cleaning apparatus removes the particle adhered to the object.

31. Cleaning liquid to be used for cleaning an object, wherein the solvent has a viscosity of 50 mPa.s or higher.

32. The cleaning liquid according to claim 31, wherein

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the pH value of the liquid is pH6 or higher.